

CLAIMS

What Is Claimed Is:

Claim 1. In a particulate matter concentration measuring apparatus for measuring a concentration of particulate matter in a sample gas collected in a collecting region formed on a collecting member, the collecting region being formed by drawing the sample gas through a cross-sectional area of the collecting member from one face side to the other face side, wherein

the collecting member is a filter tape, the filter tape includes a porous film made of a fluorine resin for trapping particulate matter in the collecting region, the filter tape includes a reinforcing layer on the porous film, the reinforcing layer allows the transmission of the sample gas.

Claim 2. The particulate matter concentration measuring apparatus of Claim 1, wherein the particulate matter concentration is measured using a beta-ray absorbing method.

Claim 3. The particulate matter concentration measuring apparatus of Claim 2, wherein the particulate matter concentration measurement includes a compensation for any error caused by naturally occurring alpha and beta radiation.

Claim 4. The particulate matter concentration measuring apparatus of Claim 1, wherein the particulate matter concentration is measured using a pressure loss method.

Claim 5. The particulate matter concentration measuring apparatus of Claim 1, wherein the filter tape presents the porous film on one face side and presents the reinforcing layer on another face side.

Claim 6. The particulate matter concentration measuring apparatus of Claim 1, wherein the reinforcing layer comprises a non-woven fabric having a low hygroscopic property.

Claim 7. The particulate matter concentration measuring apparatus of Claim 1, wherein the reinforcing layer is a non-woven fabric selected from the group consisting of polyethylene, polyethylene terephthalate, nylon, polyester and polyamide.

Claim 8. The particulate matter concentration measuring apparatus of Claim 1, further comprising:

a supporting means for supporting the filter tape in the collecting region, the supporting means having a plurality of exhaust holes for discharging the sample gas passing through the filter tape and supporting the filter tape against being deformed in the collecting region, the support means having at least four exhaust holes, the exhaust holes being disposed with approximately circular symmetry around a predetermined central position.

Claim 9. The particulate matter concentration measuring apparatus of Claim 8, wherein the supporting means includes a thin plate-like portion within which the plurality of exhaust holes are formed in a honeycomb shape.

Claim 10. The particulate matter concentration measuring apparatus of Claim 8, wherein the supporting means includes a first clamping means and a second clamping means which move together to securely hold the filter tape at a time of collecting the particulate matter while permitting the passage of the sample gas through the filter tape, the first clamping means and second clamping means being moved apart so as to release the filter tape at a time of moving the filter tape.

Claim 11. The particulate matter concentration measuring apparatus of Claim 10, wherein a recess portion is formed in the first clamping means and a corresponding convex portion is formed in the second clamping means, the complementary recess and convex portions for preventing the filter tape from being displaced during clamping.

Claim 12. The particulate matter concentration measuring apparatus of Claim 1, further comprising:

an impact type sampler for performing a filtering of particulate matter in a sample gas by removing from the sample gas the particulate matter having a large particle diameter on the basis of collisions within the sample gas and selectively sampling the particulate matter having a small particle diameter prior to collection of the particulate matter in the collecting region, the impact type sampler having a sample intake portion, the impact type sampler having an output port for conducting a filtered sample gas to the collecting region, the impact type sampler being detachably connected to the particulate matter concentration measuring apparatus.

Claim 13. The particulate matter concentration measuring apparatus of Claim 12, further comprising:

a mounting flange for mounting a sample introduction portion to the sample intake portion of the impact type sampler, the sample introduction portion being a cover body having approximately the same outer shape as an outer shape of the mounting flange and forming a pipe connection portion in a center portion thereof, the pipe connection portion having a taper-shaped receiving port.

Claim 14. The particulate matter concentration measuring apparatus of Claim 12, further comprising:

a dust removing filter for removing dust from the sample gas, the dust removing filter being detachably mounted to the pipe connection portion so as to remove dust from the sample gas prior to introduction of the sample gas into the impact type sampler.

Claim 15. The particulate matter concentration measuring apparatus of Claim 1, further comprising:

a cyclone type sampler for filtering particulate matter in a sample gas using centrifugal separation of the particulate matter prior to collection of the particulate matter in the collecting region, the cyclone type sampler having an input port for admitting the sample gas and an output port for emitting a separated sample gas, the input port of the cyclone type sampler being connected to the source of the sample gas, the cyclone type sampler output port being connected to the particulate matter concentration measuring apparatus so as to conduct the filtered sample gas to the collecting region, the cyclone type sampler being detachably connected to the particulate matter concentration measuring apparatus.

Claim 16. The particulate matter concentration measuring apparatus of Claim 1, further comprising:

an impact type sampler for performing a filtering of particulate matter in a sample gas by removing from the sample gas the particulate matter having a large particle diameter on the basis of collisions within the sample gas and selectively sampling the particulate matter having a small particle diameter prior to collection of the particulate matter in the collecting region, the impact type sampler having a sample intake portion, the impact type sampler having an output port for conducting a first filtered sample gas to the collecting region, the impact type sampler being detachably connected to the particulate matter concentration measuring apparatus;

a cyclone type sampler for filtering particulate matter in a sample gas using centrifugal separation of the particulate matter prior to collection of the particulate matter in the collecting region, the cyclone type sampler having an input port for admitting the sample gas and an output port for emitting a separated sample gas, the input port of the cyclone type sampler being connected to the source of the sample gas, the cyclone type sampler output port being connected to the particulate matter concentration measuring apparatus so as to conduct a second filtered sample gas to the collecting region, the cyclone type sampler being detachably connected to the particulate matter concentration measuring apparatus; and

a switching means for selecting between the first filtered sample gas from the impact type sampler and the second filtered sample gas from the cyclone type sampler for conducting to the collecting region.

Claim 17. The particulate matter concentration measuring apparatus of Claim 16, wherein the switching means is an electro-mechanical switch.

Claim 18. In a particulate matter concentration measuring apparatus for measuring a concentration of a particulate matter in sample gas collected in a collecting region formed on a filter medium, the collecting region being formed by drawing the sample gas through a cross-sectional area of the filter medium from one face side to another face side, including a supporting means having a plurality of exhaust holes for discharging the sample gas passing through the filter medium and supporting the filter medium against being deformed at the collecting region, the supporting means having at least four exhaust holes, the exhaust holes being formed with approximately circular symmetry around a predetermined central position.

Claim 19. The particulate matter concentration measuring apparatus of Claim 18, wherein the supporting means includes a thin plate-like portion within which the plurality of exhaust holes are formed in a honeycomb shape.

Claim 20. A filter tape for measuring the concentration of a particulate matter, the filter tape including a porous film made of a fluorine resin, and a reinforcing layer provided on the porous film, the reinforcing layer comprising a non-woven fabric having a low hygroscopic property selected from the group consisting of polyethylene, polyethylene terephthalate, nylon, polyester and polyamide.

Claim 21. A method of measuring particulate matter concentration in a sample gas, comprising the steps of:

drawing a sample gas containing a quantity of particulate matter through a collecting member to form a collecting region, a predetermined portion of the particulate matter in the sample gas being trapped in the collecting region;

irradiating the particulate matter in the collecting region using a beta-ray source;

detecting the beta-rays passed through the collecting region to provide a representative signal;

measuring the concentration of the particulate matter based on the representative signal; and

compensating for any error caused by naturally occurring alpha-rays and beta-rays.